GENERAL DYNAMICS

Ordnance and Tactical Systems

S40mm APFSDS-T & HEAB-T Development

39th Gun and Ammunition Conference

14 April 2004

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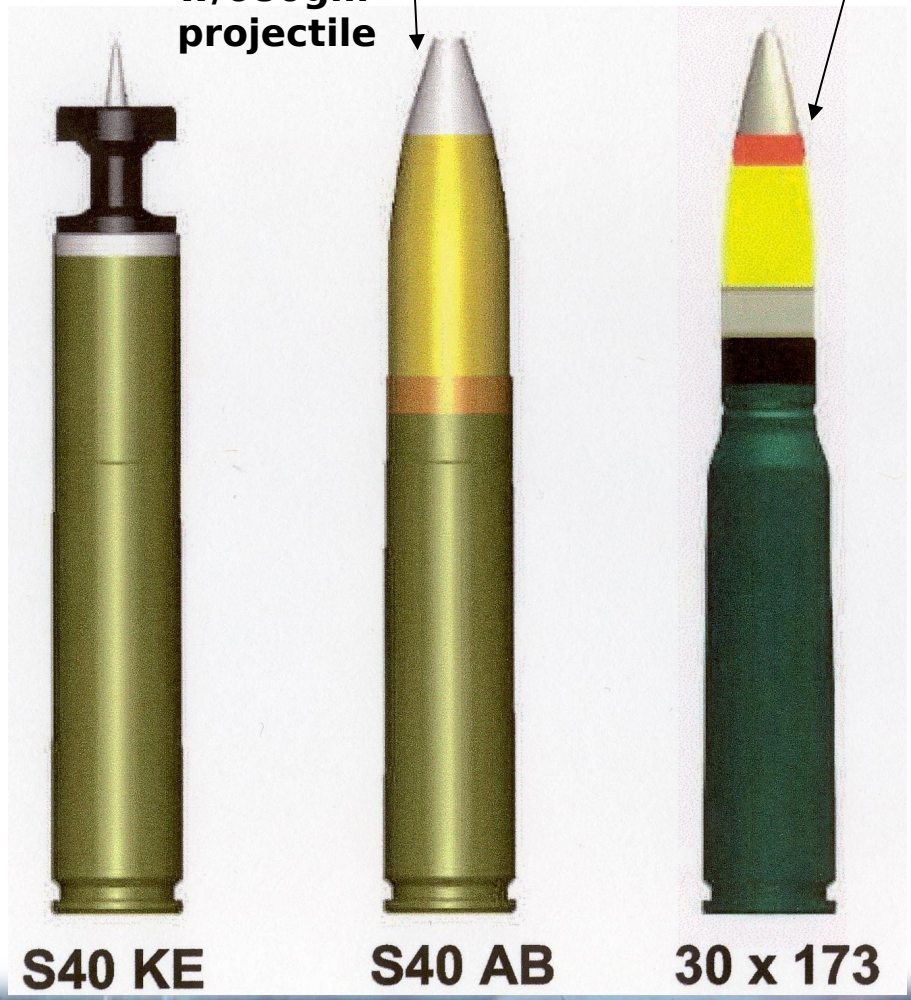
30/40mm Comparison
What is Super 40mm?

Cartridge OAL = 289.97mm

Current ALACV Design

W/2 Case Lengths

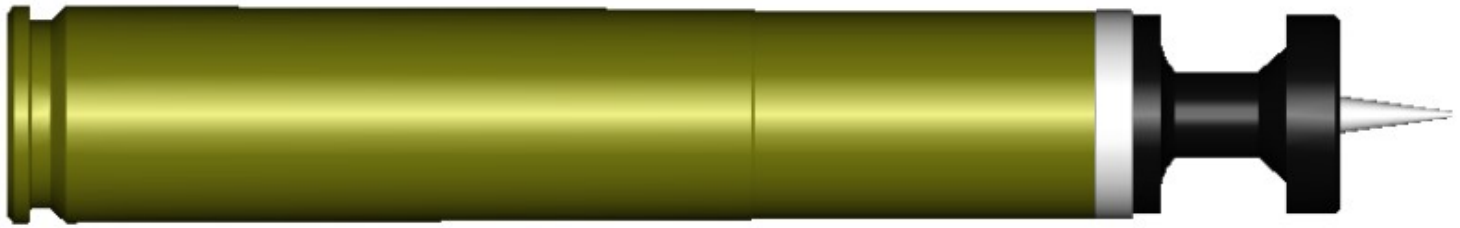


S40mm Ammunition & Status

Ammunition Family Consists of:

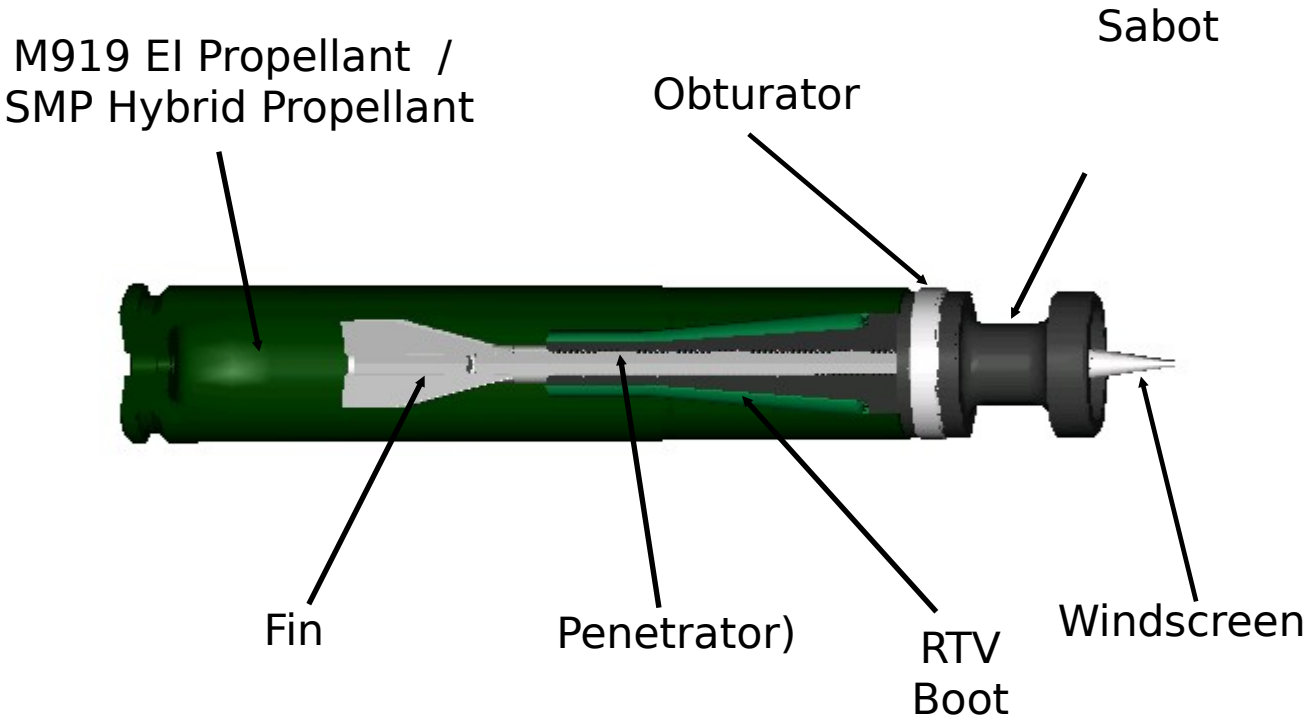
- APFSDS-T (Armor Piercing Fin Stabilized Discarding Sabot – Traced)
  - Baseline design with aluminum sabot tested
  - Baseline design with lightweight sabot tested
- TPDS-T (Target Practice Discarding Sabot – Traced)
- HEAB-T (High Explosive Air Burst – Traced)
  - Gen I design with GD-OTS fuze assembly tested
- TP-T (Target Practice – Traced) TP for Airburst
  - Designed and tested
- TP-S (Target Practice – Spotter)
  - Designed and tested

S40mm APFSDS-T Status



- **Baseline design with 218mm long case**
  - Demonstrated from Mann Barrel and MK44 Auto-Gun at High Rate Burst.
  - Demonstrated Dispersion at 2k = .32 x .33 mr
  - Maximum muzzle velocity capability with this design ~1350m/s
- **Optimized Design with Common Case**
  - Design concept completed
  - Phase I testing with lightweight sabot completed in Feb 04
  - Muzzle velocity capability with this design ~ 1460m/s

ALACV Super 40mm APFSDS-T



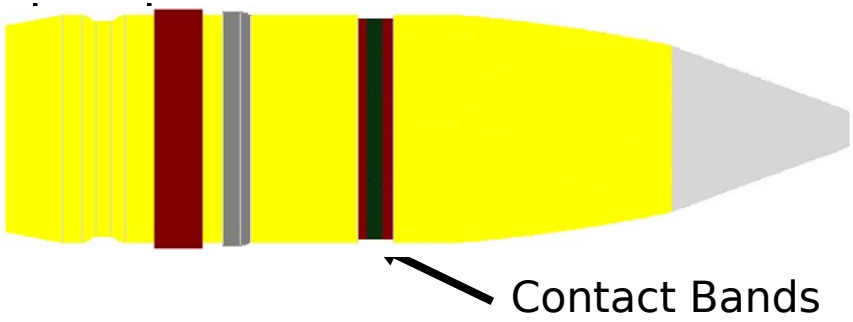
ALACV Super 40mm APFSDS-T

Phase I Light Weight Sabot

S40mm AirBurst Demonstration

Fuze Setting

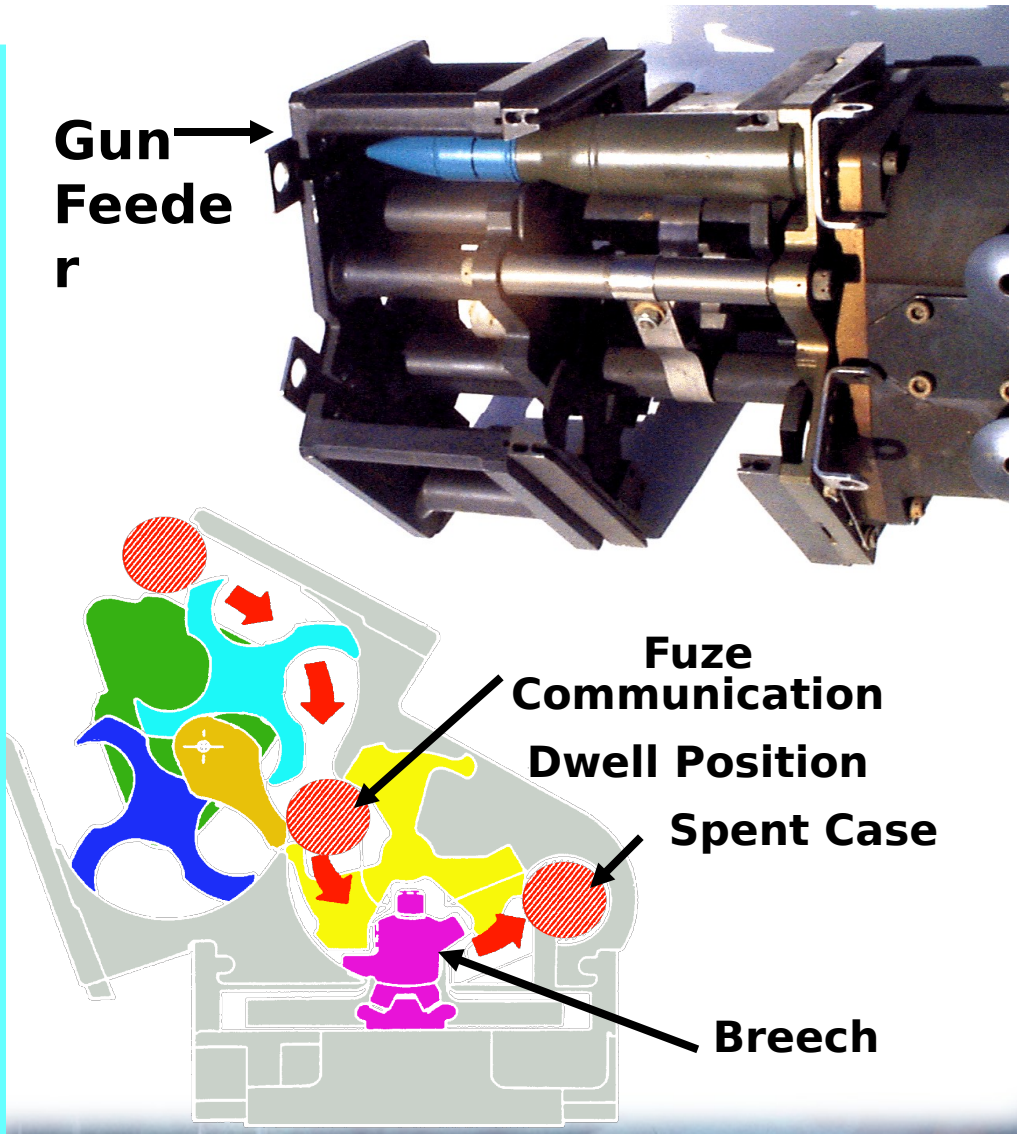
- The 30/40mm HEAB rounds use a contact communication system similar to that currently used for the ACSW. (Fuze commonality)
- Burst point is based on Time of Flight calculation.
- (2) contact bands are located on the bourrelet of the projectile forward of the drivin



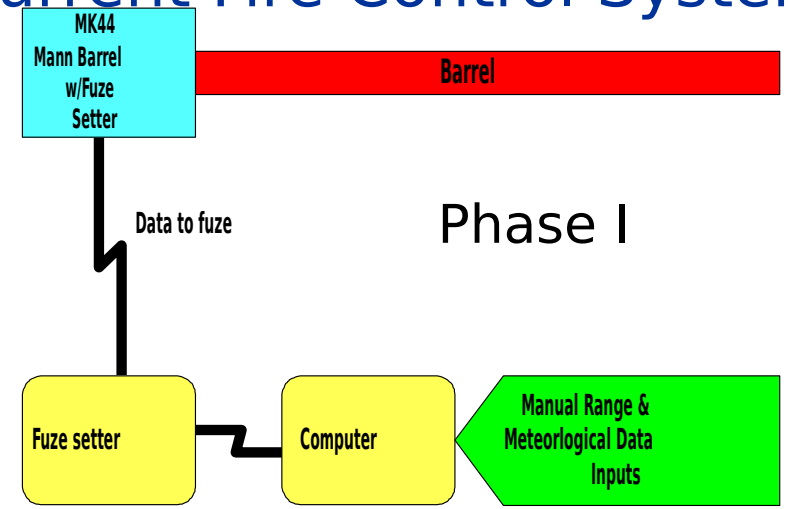
- We communicate and set the fuze after it is chambered in the Mann Barrel or in the Auto gun .
- We have demonstrated contacting and setting the fuze in the feed system of the MK44 auto gun at HRB of 200 SPM.

GD-OTS AirBurst Fuze Contactor

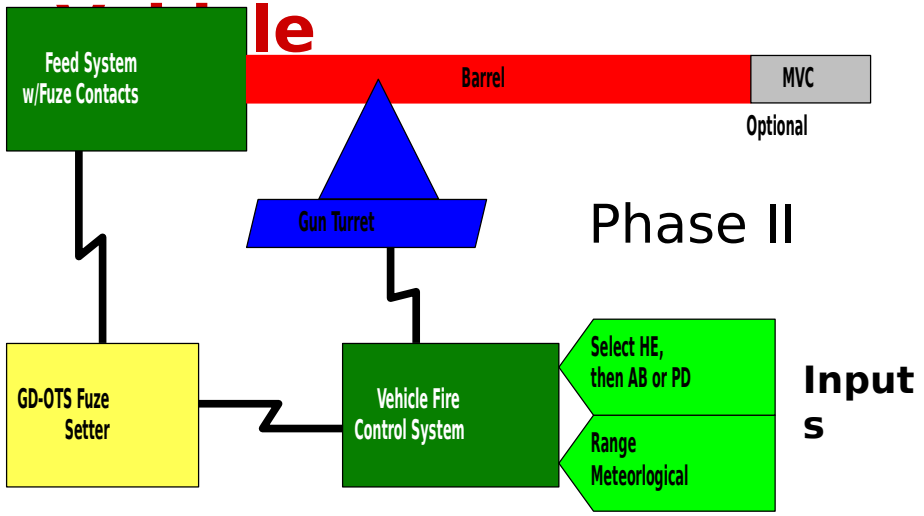
- Fuze contactor/setter system demonstrated in MK44 auto gun
- Air Burst Set & Function demonstrated from 225m to 2800m
- Fuze Set & Fired @ High Rate Burst rates
- Burst Accuracies ~ 2.5m SD @ 1500m @ ATC
- Digressive & Progressive String of Pearls Demonstrated



30/40mm AirBurst Current Fire Control System



30/40mm AirBurst Integrated into Vehicle



Current Demonstration

Matured Design: The HEAB-T round will default to a Point Detonate (PD) function if an object is struck before the timer functions.

Point and Shoot Capabilit

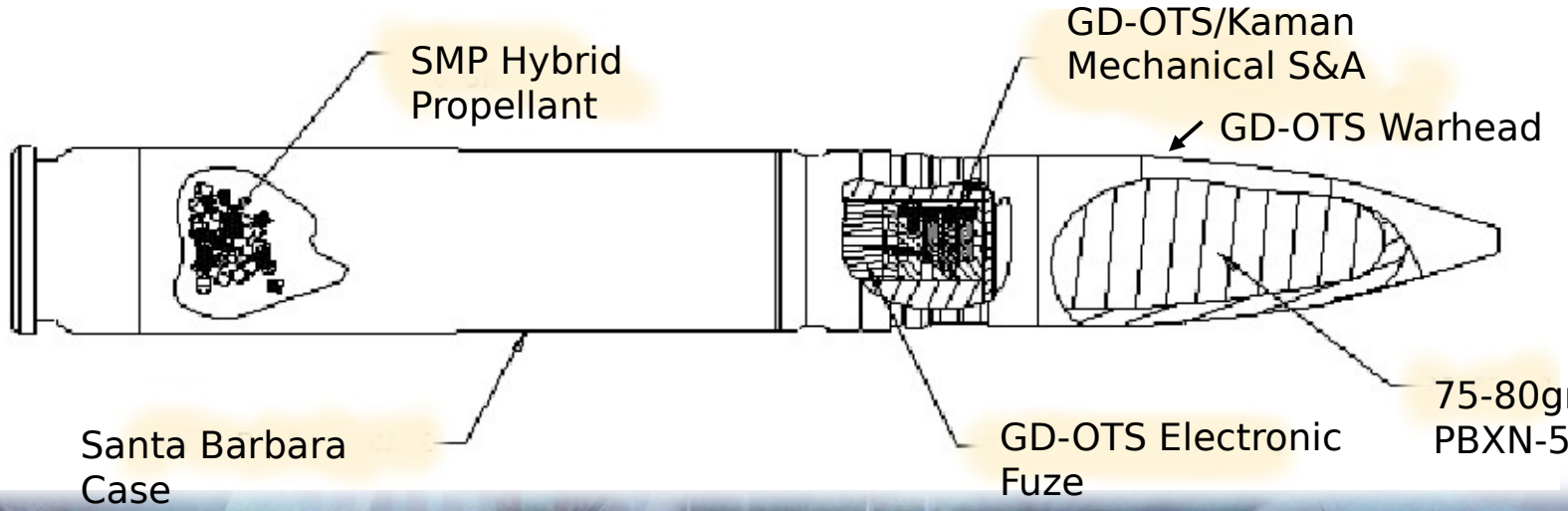
Phase III

Total integration into vehicle fire control system

S40mm AirBurst

S40mm IRAD Progress Continued

- **S40mm AirBurst HEAB-T Gen I (680 gm) w/Base Mounted Fuze**
  - Successful test of S40mm HEAB with 75gm (actual) PBXN-5 charge on February 19, 2004
  - Muzzle Velocity ~1000m/s



S40mm AirBurst Demonstration – Feb 19, 2004

Test Set-Up

- S40mm MK44 Mann Barrel
- Smash Plate @ ~615m
- Tarps on the ground forward of the smash plate
- Mannequins (standing & prone) are placed at approx. 600m.
- Weibel Radar
- Cameras
  - (2) sideline video at target site
  - (1) sideline High Speed video at target site
  - (1) video located at ~540 meters looking downrange at the target site
  - (1) video located at the target looking up range at the burst location
  - (1) video looking downrange from over the gun

S40mm HEAB-T Feb 19, 2004

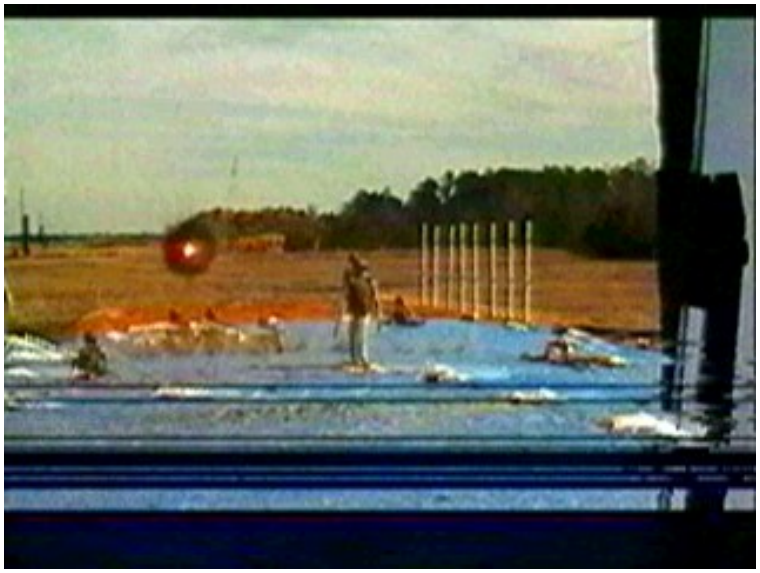
Our Dummies on the way to work

Is this where we are supposed to be?

S40mm HEAB-T Feb 19, 2004

S40mm HEAB Hits

S40mm HEAB-T Feb 19, 2004



S40mm HEAB-T Feb 19, 2004

S40mm HEAB-T Demonstration February 19, 2004

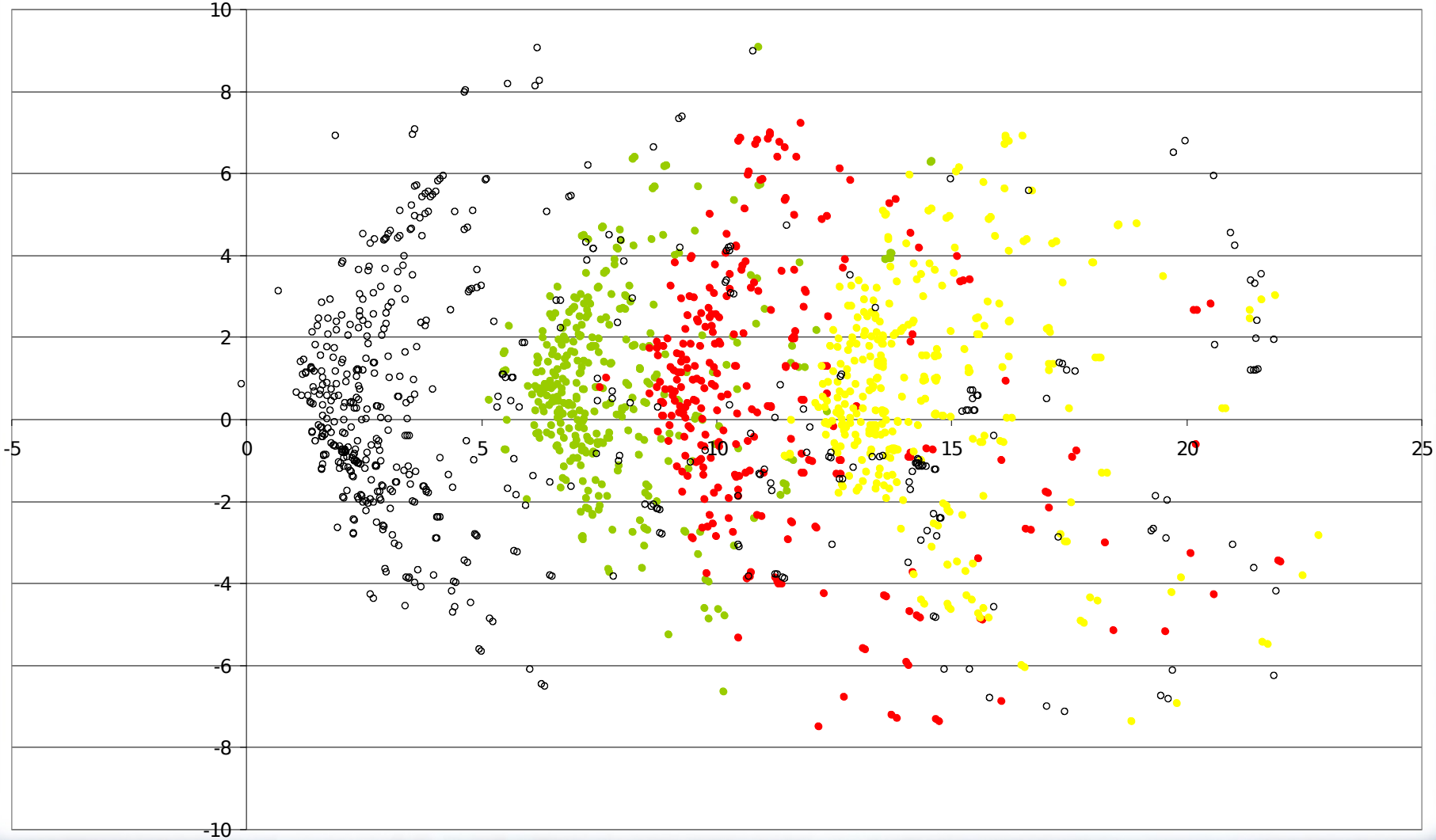
High Speed Video of Round #4

(AVI Video 5 – 7 seconds)

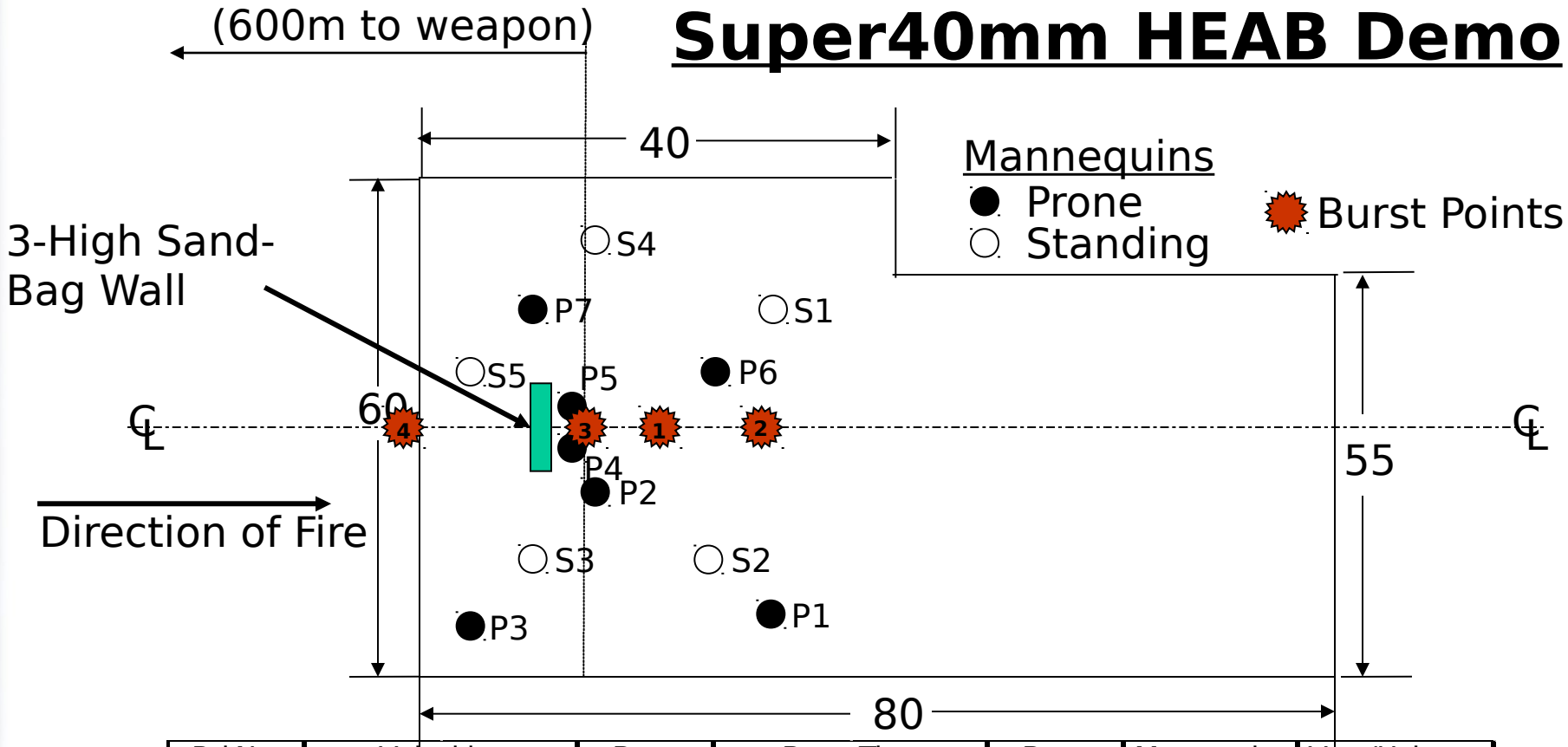
S40mm HEAB-T Demonstration February 19, 2004

If this had been a “String of Pearls”, this is how it would have looked.

GD-OTS S40mm FOOTPRINT



Super40mm HEAB Demo



Rd No.	Velocities		Burst Distance	Burst Time		Burst Height	Mannequins Hits	Vest/Helmets Perfs
	Muzzle	Burst		Predicted	Actual			
Heab-01	998.6	782	602.1m	681ms	682ms	2.95	4 (S1,S2,P2,P6)	3 (S2)
Heab-02	1004.1	793.4	605m	678ms	678ms	1.61	0	0
Heab-03	1008.5	790.4	599.5m	670ms	671ms	1.66	4 (P1,P2,P6,S2)	4 (S2,P2)
Heab-04	1002.3	790.6	594.7m	667ms	668ms	2.06	8 (S2,S3,S4,S5, P3,P4,P5,P7)	0
Impacted 12 of 12 Mannequins with a total of 55 Fragments								

S40mm AirBurst & APFSDS-T

SUMMARY – GD-OTS S40mm Status at End of CY

APFSDS-T

- Projectile designs for baseline case and common case
- Test fired from a MK44 auto gun
- Light Weight sabot manufacture, LAP & Test
- 1450m/s velocity objective can be achieved with common case and lightweight GD-OTS sabot

AirBurst

- AirBurst Simulator/Trainer designed and tested
- HEAB-T with base mounted fuze successfully tested.
- Lethality analysis with mid-body fuze completed by ARDEC
- Capable of being fired from MK44 auto-gun w/String of Pearls

Why S40mm?

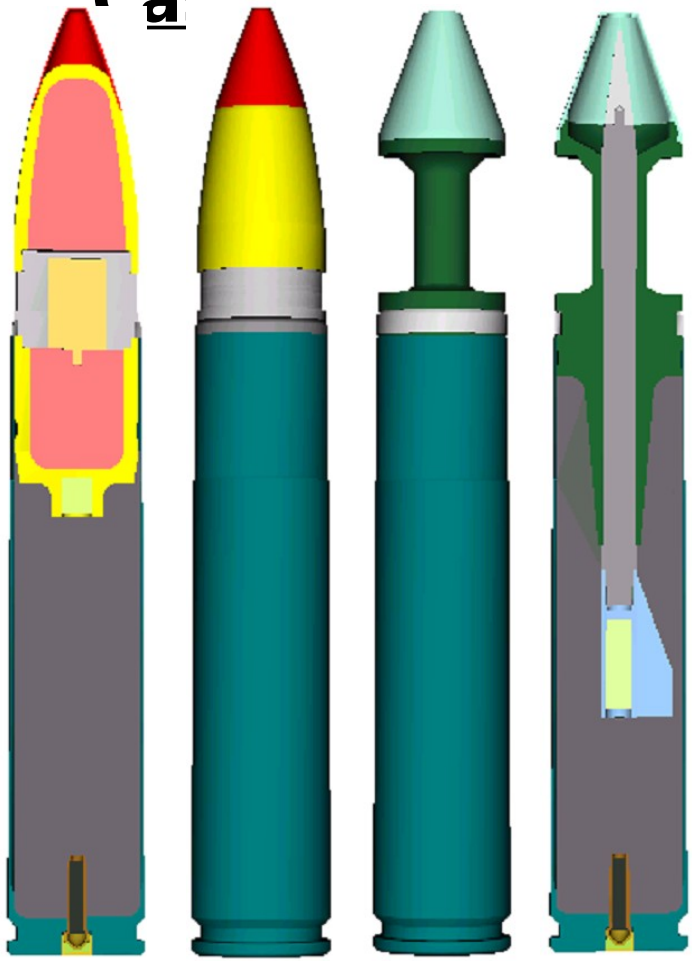
INCREASED LETHALITY

AirBurst	Explosive Weight	Projectile Weight
S40mm	>80gm	725gm
30mm	40gm	440gm
25mm	24gm	225gm

APFSDS-T	Flight Weight
S40mm	230gm
30mm	156gm
25mm	98gm

S40mm AirBurst & APFSDS-T

S40mm HEAB-T & APFSDS-T with Common Case



S40mm IRAD

"Parametric Study" (GD-OTS/Arrow Tech) to Determine Optimum Case Design is complete

- 190 - 195mm common case length appears best
- APFSDS-T muzzle velocity of >1450m/s will meet lethality objective with the GD-OTS penetrator/sabot design.
- HEAB-T would design deliver 725gm warhead with ~80gm explosive – muzzle velocity ~970m/s

30/40mm AirBurst

Summary

1. GD-OTS has demonstrated the capability to set AB rounds and fire at high rate burst speeds in the MK 44 gun. String of Pearls capability demonstrated.
2. GD-OTS demonstrated 30mm and 40mm HEAB rounds on Feb 18 & 19, 2004.
3. GD-OTS has fired S40mm APFSDS-T with a lightweight sabot using Wimmis EI & Hybrid propellant on Feb 20, 2004.
4. The GD-OTS Fuze package will fit into cannon caliber ammunition from 25mm (M242), 30/40mm (MK44) to 35/50mm (Bush III).